18p-A12-13

Lithium aluminate and silicate crystals for neutron scintillators

IMR, Tohoku Univ. [1], Institute of Physics AS Czech Republic[2], NICHe, Tohoku Univ. [3],

°Jan Pejchal[1,2], Vladimir Babin[2], Romana Kucerkova[2], Shunsuke Kurosawa[1,3], Yuui Yokota[3], Martin Nikl[2], Akira Yoshikawa[1,3]

E-mail: pejchalj@imr.tohoku.ac.jp

A need for an efficient neutron scintillator has been increased recently with the development of new neutron spallation sources, which are designed as a new probe for material sciences. Another possible application can be for example security scanning using neutron radiation. Recently we have shown that 0.1% Ti-doped $LiAlO_2$ crystal can be a good candidate for novel neutron scintillation material due to Li-content and low density of about 2.75 g/cm^3. The light yield of the sample grown by micro-pulling-down method was determined to be around 6000 photons/neutron, emission spectrum placed at 380 nm and reasonable decay time of 2.5 μs. More detailed luminescence studies revealed also defect emission of unknown origin at 350nm and 446nm and slow Fe^{3+} impurity luminescence in the deep-red region. Temperature dependences of these luminescence processes and their interplay will be presented and discussed together with influence of Mg^{2+} codoping.

Another possible candidate can be the Ti-doped Li_4SiO_4 crystal with even lower density (2.35 g/cm^3) and higher Li content. Similarly as for the $LiAlO_2$:Ti the micro-pulling-down method was optimized for crystal growth of Li_4SiO_4 taking into account the Li evaporation. The comparison of the X-ray-excited radioluminescence spectra of the Ti 0.2% -doped Li_4SiO_4 single crystal with $Bi_4Ge_3O_{12}$ (BGO) standard scintillator is shown in the figure 1. We can see that the overall scintillation efficiency reaches somehow above 50% of that of BGO. It may be also influenced by slightly lowered quality of the sample surface. If we take account this and also possibility of further increasing the Ti concentration, Li_4SiO_4:Ti can be a promising neutron scintillator. Basic luminescence study of this material system will be presented and discussed.

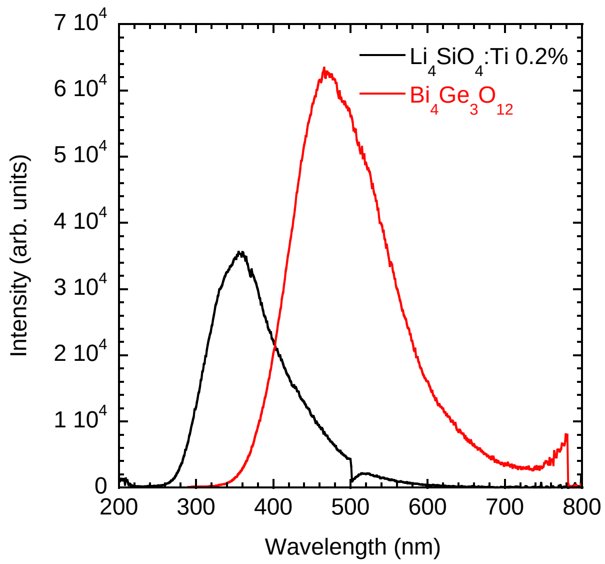

Figure 1. Comparison of the X-ray-excited radioluminescence spectra of Li_4SiO_4:Ti 0.2% with BGO standard scintillator.